National Transportation Safety Board

Motorcoach Run Off Road – Collision With Vertical Highway Signpost
Interstate Highway 95 Southbound
New York City, New York
March 12, 2011, 5:38 a.m. EST

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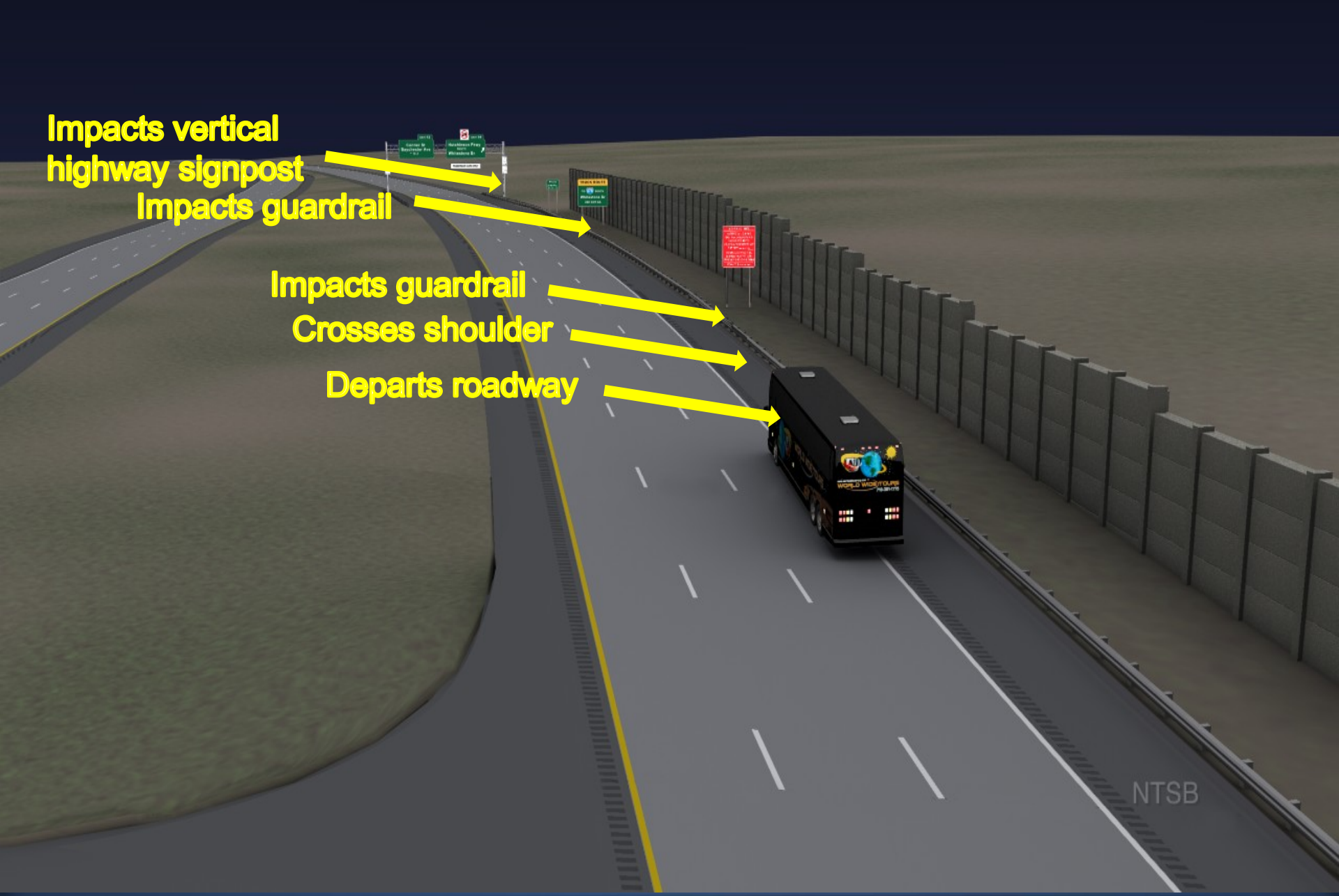
Opening Statement

Aerial View - Accident Location


Impacts vertical highway signpost
Impacts guardrail
Impacts guardrail
Crosses shoulder
Departs roadway
NTSB


Angle of departure


DESIGNATED ROUTES & TIMES
PENALTY: $ 10,000 & 30 DAYS
TRUCK ROUTE
TO 678 SOUTH
Whitestone Br
USE EXIT 6A
Conner St
Baychester Ave
Hutchinson Pkwy
South
Whitestone Br

NTSB


TRUCK ROUTE
INTERSTATE
TO 678 SOUTH
Whitestone Br
USE EXIT 6A
EXIT 14
Hutchinson Pkwy
SOUTH
PASSENGER CARS ONLY

NTSB


RED LIGHTS
PHOTO
ENFORCED
TRUCK RESTRICTION
USE ONLY
DESIGNATED
TRUCK ROUTES
EXIT ONLY AT
POINT CLOSEST
TO DESTINATION
SPEED
LIMIT
50
WORLD WIDE

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Injuries

- Motorcoach passengers
  - 15 fatalities
  - 17 serious-to-minor injuries
- Motorcoach driver
  - Minor injuries

Parties to Investigation

- Federal Highway Administration
- Federal Motor Carrier Safety Administration
- New York State Thruway Authority
- New York State DOT
- New York State Police
- New York State Motor Carrier Safety Bureau
- World Wide Travel of Greater New York
- Prevost

Safety Issues

- Motorcoach driver fatigue and onboard monitoring systems
- Commercial driver license history
- Heavy vehicle speed limiters
- Safety management systems and motor carrier safety ratings
- Roadside barriers for heavy commercial passenger vehicles
- Occupant injuries and motorcoach crashworthiness

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Human Performance

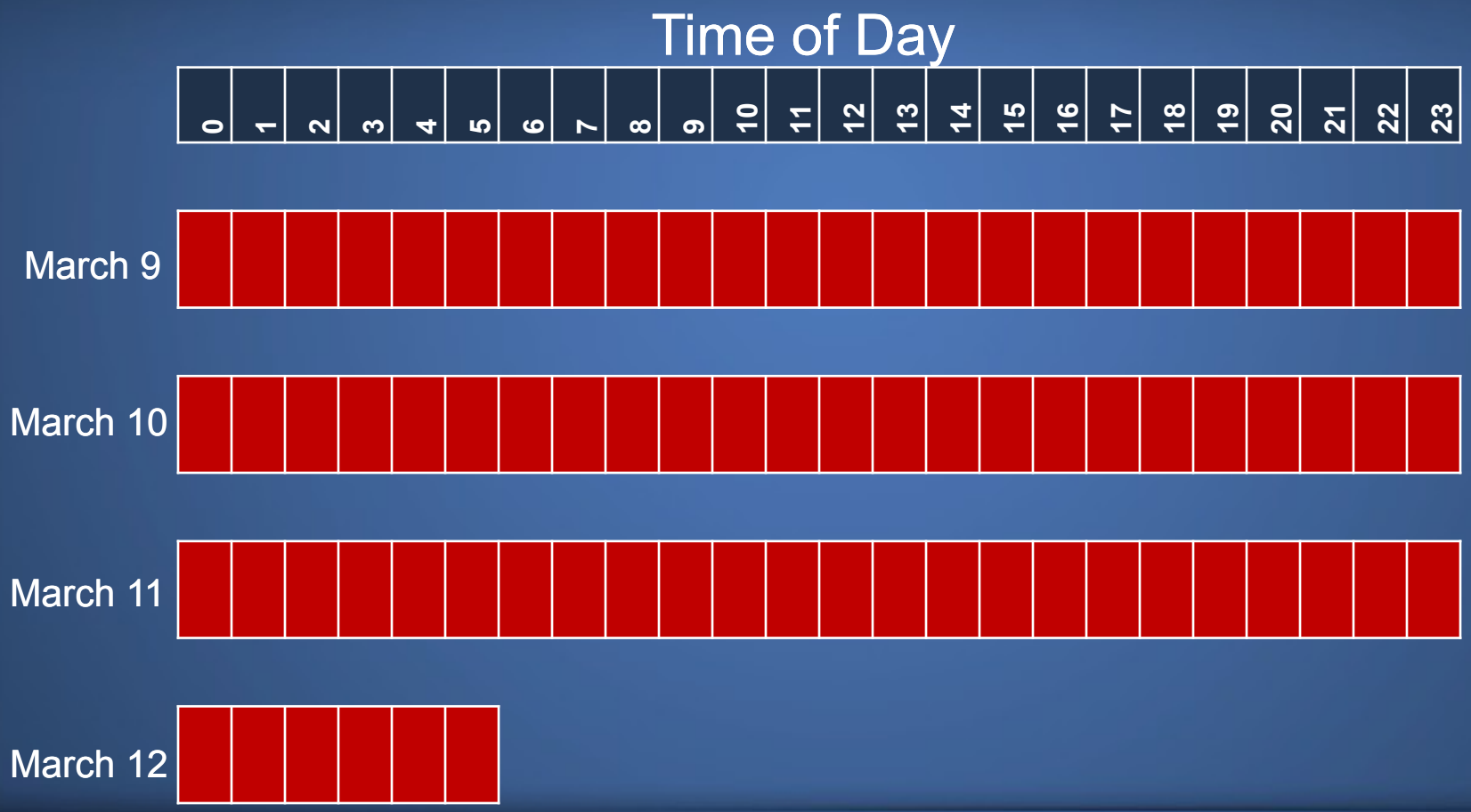
Overview

- Driver fatigue
  - Fatigue risk factors
  - Driver performance
  - Fatigued driving countermeasures
- Heavy vehicle speed limiters

Sleep Quantity and Quality

- Driver self-reported 7.5 hours sleep on workdays; 13–16 hours on days off
- Cell phone and car rental records indicate few sleep opportunities

Driver Sleep Opportunities



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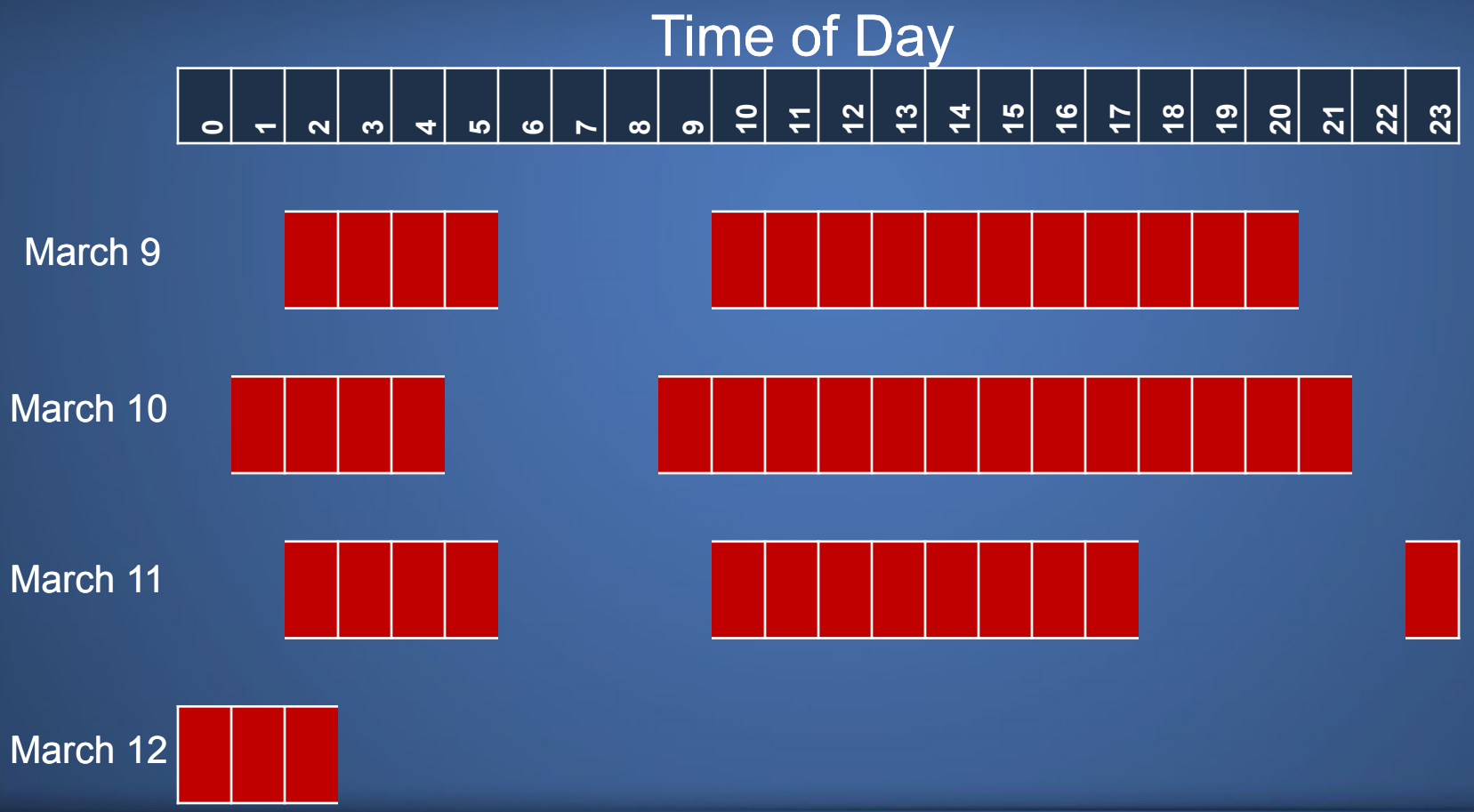
Driver Sleep Opportunities



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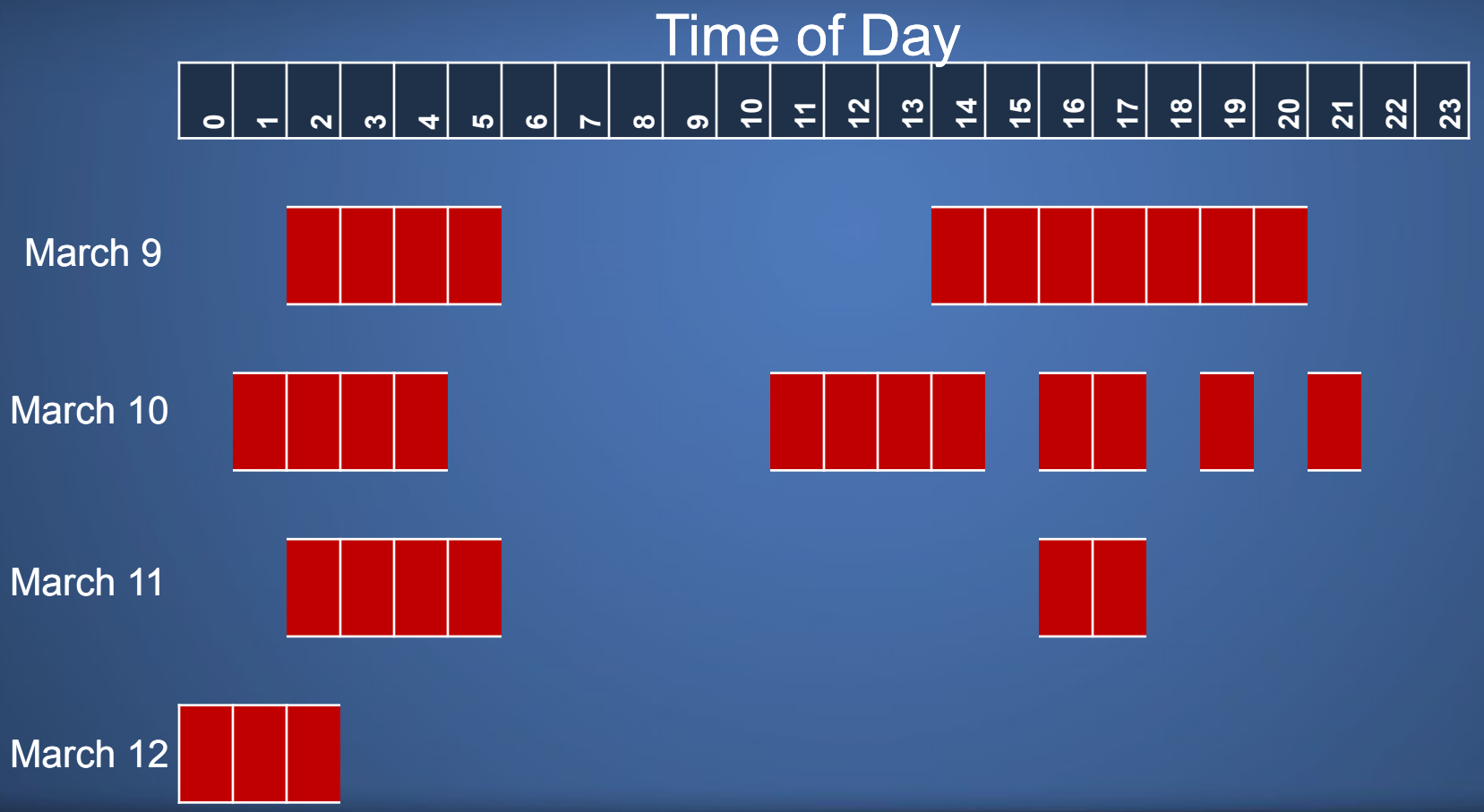

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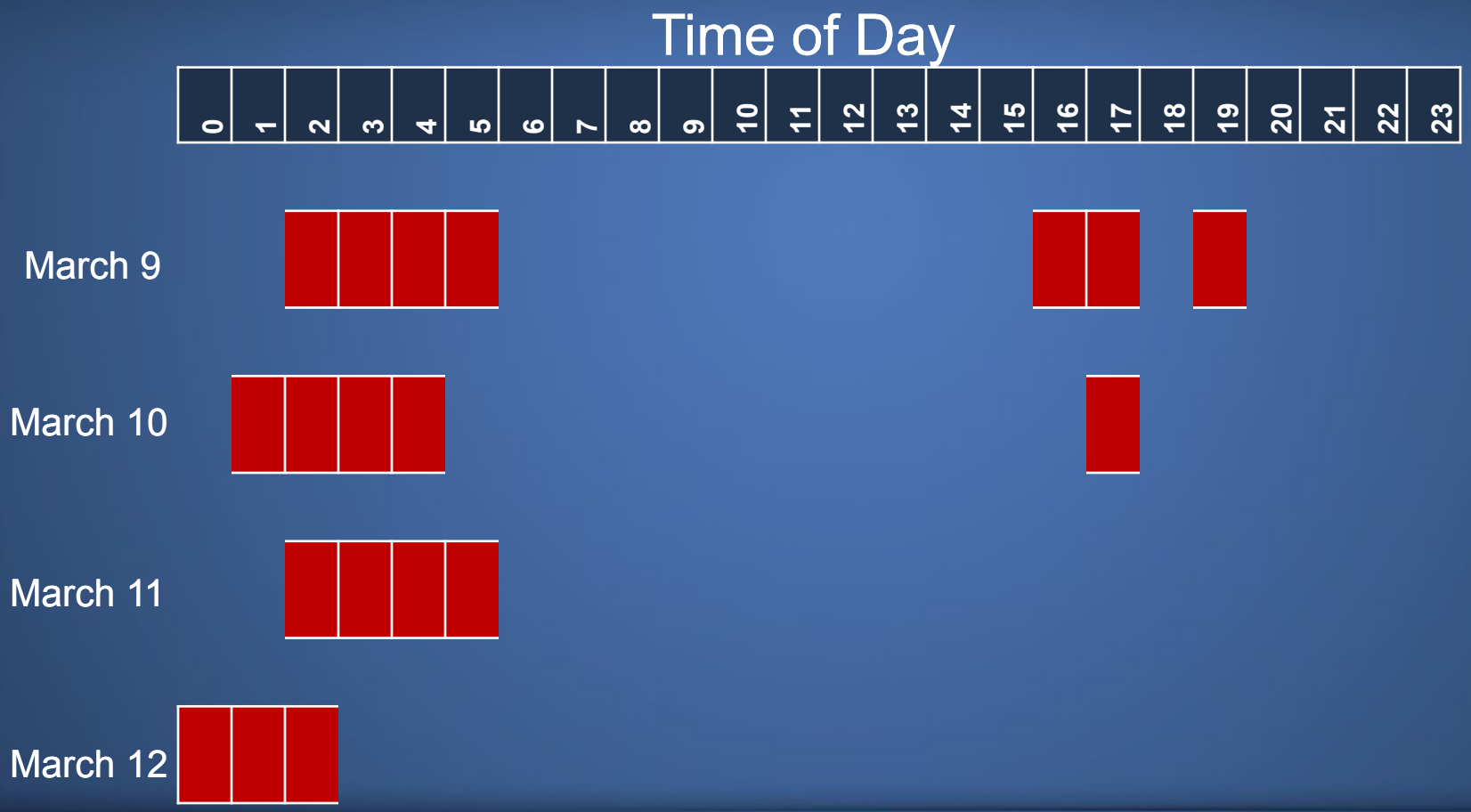
Driver Sleep Opportunities



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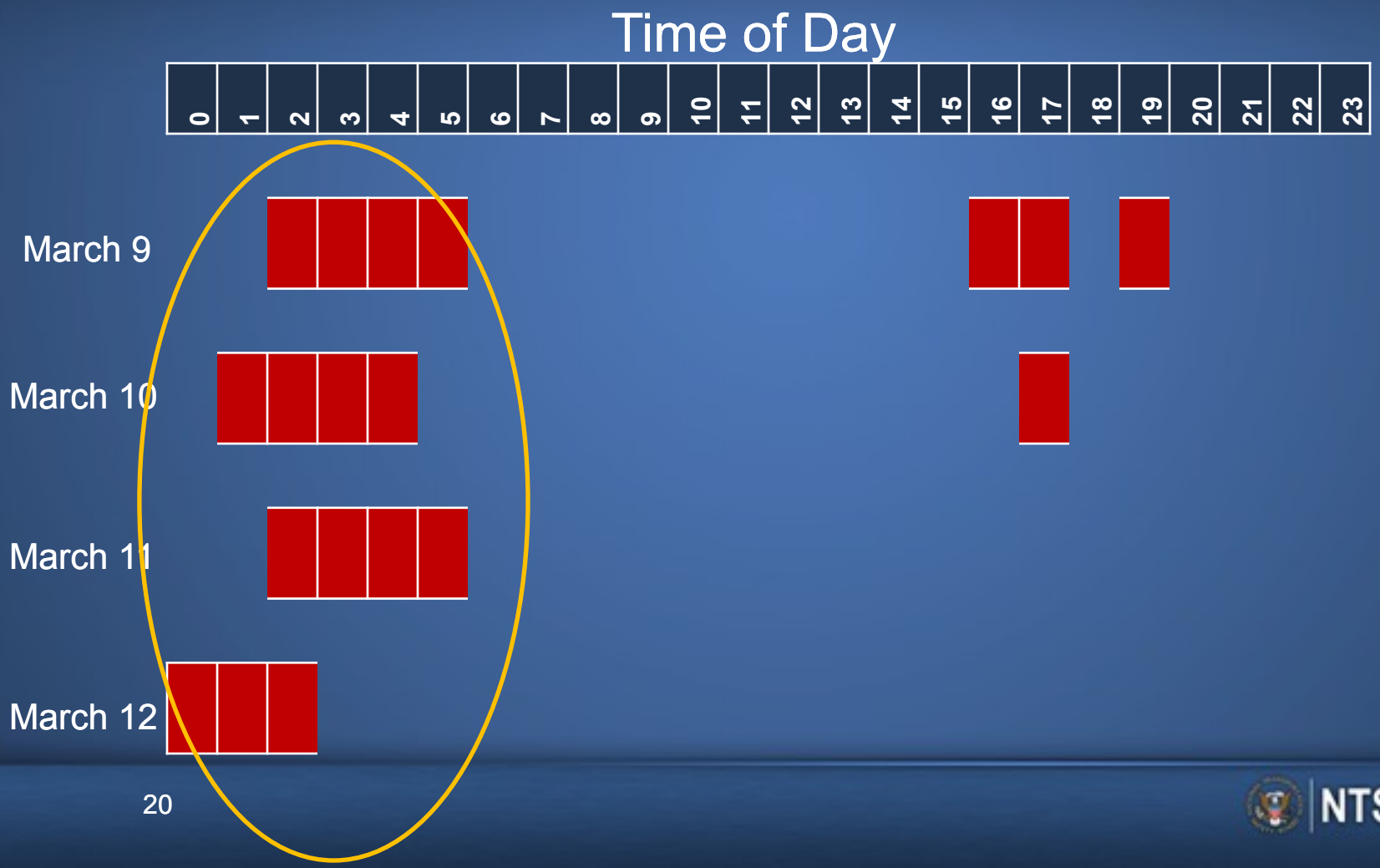
Driver Sleep Opportunities



Circadian Factors

- Night shift work
  - Reduced sleep lengths
  - More waking sleepiness
  - Degraded performance
- Circadian dysrhythmia from variability in sleep times
- Time of day – 5:38 a.m. – during circadian trough

Driver Performance

- Multiple lane excursions over rumble strips
- Lack of evasive steering
- No evidence of braking
- In sum, driver performance consistent with his fatigued state

Fatigue Countermeasures

- Sleep disorder detection and treatment
- Fatigue education
- Vehicle-based warning systems
- Fatigue management programs
- Targeting of unsafe driving behaviors

On Board Monitoring Systems (OBMS)

- Systems that allow for
  - Online measurement of unsafe driving behaviors
  - Real-time feedback to driver
  - Reports of driver performance for training purposes

OBMS Advantages

- Offer continuous or event-based sampling
- Reward positive behaviors
- Correct negative behaviors before an accident occurs
- FMCSA field operational test underway

Vehicle Speed

- Posted speed limit: 50 mph
- Bus speed:
  - 78 mph within 60 seconds of accident
  - 64 mph as bus impacted guardrail
- At lower speeds, bus rollover could have been prevented

Speed Limiters

- Conventional speed limiters cap maximum speed
- Required in several countries, with limits between 56–65 mph
- Not required in United States
- Bus speed limiter set at 78 mph

Advanced Speed Limiting

- Use GPS or camera-based sign-reading technologies
- Vary governed speeds
- Available in other countries; under development in United States
- Potential to reduce speed-related accidents

Summary

- Driver performance degraded by fatigue
- At lower speeds, rollover could have been prevented
- OBMS and advanced speed limiters increase safety

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Motor Carrier Factors

Overview

- Postaccident compliance reviews and lack of corporate safety controls
- Need for improvement in access to driver applicant driving histories by prospective employers

World Wide Travel of Greater New York

- Compliance reviews
  - 1999 – Satisfactory
  - 2007 – Satisfactory
  - 2008 – Satisfactory
  - 2011 – Unsatisfactory (postaccident)
- Currently out of service

Great Escapes Tours & Travel Ltd.

- Compliance reviews
  - 2006 - Conditional
  - 2007 – Satisfactory
  - 2008 – Satisfactory
  - 2011 – Conditional (postaccident)

Safety Management Controls

- Did not adequately monitor accident driver's logbooks
- World Wide and Great Escapes lacked sufficient safety management controls

Great Escapes Tours & Travel Ltd.

- Great Escapes acquired World Wide's assets
- BASICs alert scores
  - Fatigued driver
  - Driver fitness
- November 18, 2011 - Nonrated compliance review showed safety weaknesses in their management controls
- Great Escapes continues to operate

Safety Management Controls

- FMCSAs – Safety Management Cycle
- 6 safety management processes
- Identify deficiencies in safety management controls

Safety Management Cycle

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Driving Records

- Employer driver record check
  - 49 CFR 391.23 – 3-year history
  - States supply 3-year driving history unless a longer time is requested and if state regulations permit
  - Drivers required to report citations and accidents
  - Annual checks

Accident Driver

- Hired by World Wide – November 17, 2010
- World Wide driver's history
  - 2 suspensions (failure to pay child support)
  - 2 restricted license
  - No violations

Accident Driver

- Pre-1995 privilege to drive suspensions still in effect at time of accident
- Driving history 1995 - 2011
  - First license issued in 1995
  - 7 violations
  - 8 suspensions

Driving Records

- Other driver's driving history
  - Munfordville, Kentucky
  - Doswell, Virginia
  - Miriam, Nevada
- All employer inquiries indicated fewer entries
  - Violations
  - Accidents
  - Suspensions

Driving Records

- Insufficient driver record supplied to carrier
- 10-year CMV employment history
- Goal – preventing accidents, injuries, and fatalities

Summary

- World Wide and Great Escapes both lacked adequate safety management controls
- FMCSA's Safety Management Cycle methodology can help carriers identify area of management weakness

Summary

- Drivers with poor driving records are more likely to be involved in a future accident
- Carriers are not being provided with a sufficient length of driver history

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Roadside Barriers for Heavy Commercial Passenger Vehicles

Overview

- Selection of higher performance roadside barriers
- Redirection of modern commercial passenger vehicles

Clear Zone Concept

- Traversable and unobstructed roadside area for use by errant vehicles
- Usually set at 30 feet
- Permits recovery space for 80% of vehicles leaving roadway
- Obstacles located in clear zone should be removed, relocated, or shielded by traffic barriers


EXIT 13
Conner St
Baychester Ave
½ MILE
EXIT 14
Hutchinson Pkwy
SOUTH
Whitestone Br
PASSENGER CARS ONLY
NYC LAW
NO
TURN
ON RED
Vertical
Highway
Signposts
10-foot wide
5-foot
Right Shoulder
W-beam
Guardrail

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General Roadside Design Practice

- Satisfactory clear zones whenever practical
- Appropriately designed barriers when clear zones are impractical
- Economical design and placement of sign structures

AASHTO Guidance

- AASHTO guidance in 1980s: "*removal of fixed objects in the clear zone should be first alternative considered*"
- NYSTA chose to locate vertical highway signposts in clear zone and shield with W-beam guardrail, which was *not* designed to redirect a heavy vehicle such as accident motorcoach

Description of Test Levels

- TL-3 redirects passenger cars and pickup trucks
- Higher performance barriers redirect heavy vehicles
  - TL-4, single-unit truck
  - TL-5, tractor-van trailer
  - TL-6, tractor-tanker trailer

Test Level	NCHRP Report 350 (1993–Old)	MASH (2009–New)
TL-3	Passenger car: 1,800 lb Pickup truck: 4,400 lb	Passenger car: 2,420 lb Pickup truck: 5,000 lb
TL-4	Single-unit truck: 17,600 lb	Single-unit truck: 22,000 lb
Weight of accident motorcoach = 52,000 lb		
TL-5	Tractor-van trailer: 80,000 lb	Tractor-van trailer: 79,300 lb
TL-6	Tractor-tanker trailer: 80,000 lb	Tractor-tanker trailer: 79,300 lb


Rail element completely separates from posts
Posts deformed and turned down 90 degrees
Posts deformed and turned down 45 degrees
DESIGNATED TRUCK ROUTES
EXIT ONLY AT POINT CLOSEST TO DESTINATION
SPEED LIMIT 50

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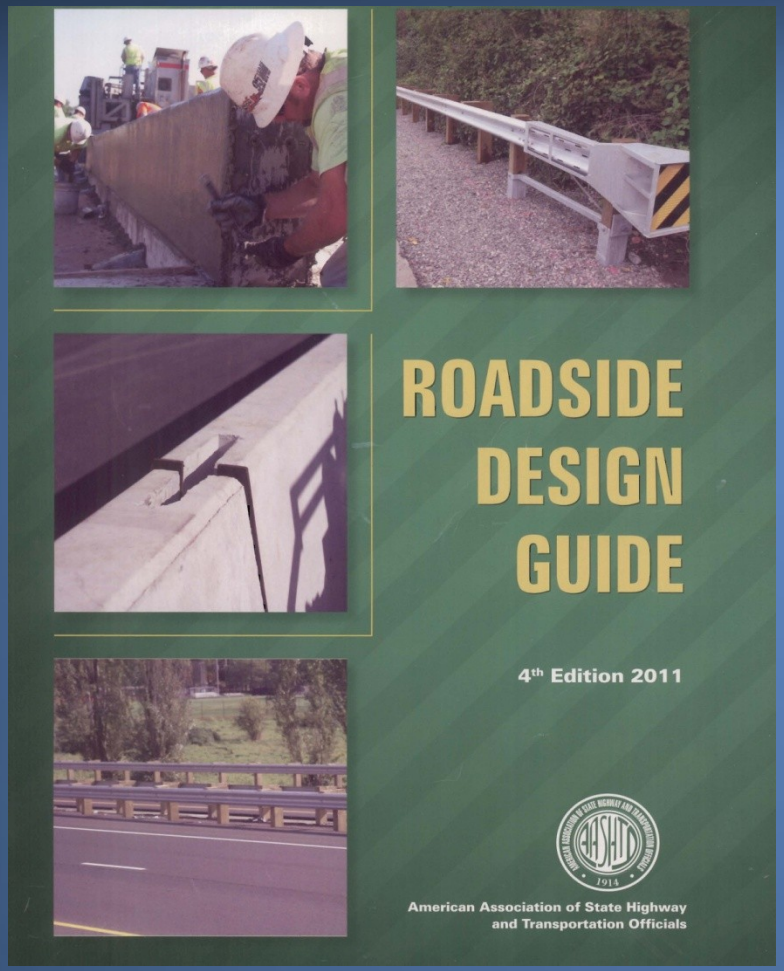
AASHTO Roadside Design Guide



- No objective warrants for higher performance roadside barriers
- Barrier recommendations based on subjective analysis
- Roadside Safety Analysis Program (RSAP)

Roadside Safety Analysis Tools

- Accident site conditions on I-95 were used as input into roadside safety analysis tools
- Guidance recommended TL-3 barrier
- Safety analysis tools do not provide adequate guidance for evaluating commercial passenger vehicles

Summary

- Commercial passenger vehicle fleet is not reflected in current crash tests
- *AASHTO Roadside Design Guide* does not contain objective warrants for use of higher performance barriers
- Higher performance barriers should be used in corridors that are frequently traveled by commercial passenger vehicle traffic

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Vehicle Crashworthiness and Occupant Protection

Injury Information

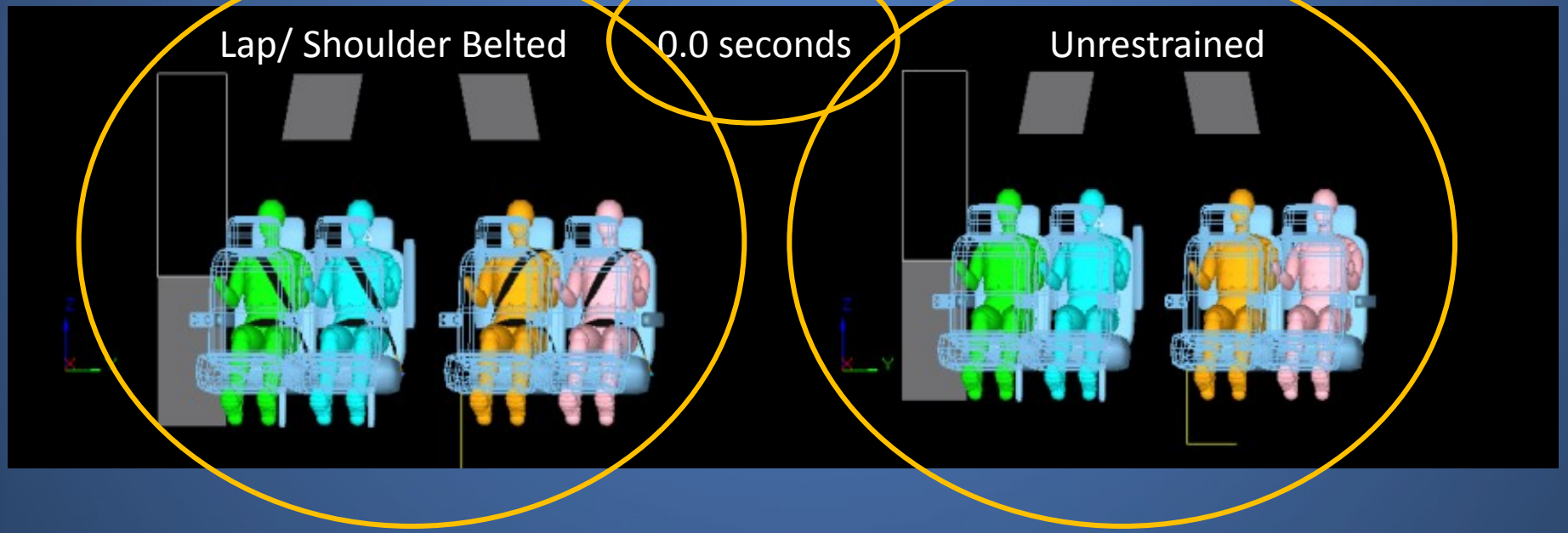
- Motorcoach occupants
  - 32 passengers (total capacity 56)
    - 15 fatalities
    - 7 serious injuries
    - 10 minor injuries
  - Driver – minor injuries
- Preaccident seat location for 9 occupants

Occupant Protection

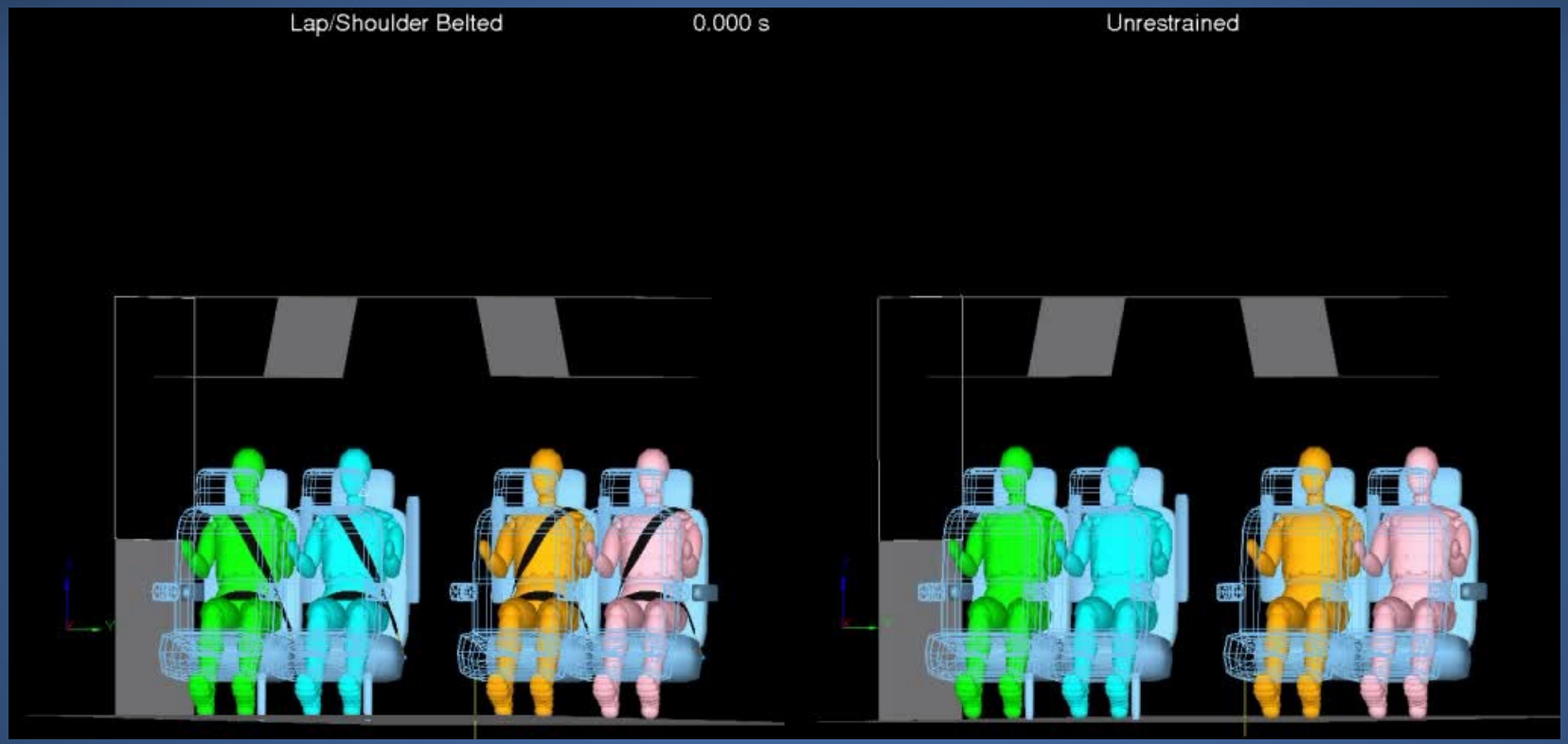
- National Highway Traffic Safety Administration published Notice of Proposed Rulemaking (NPRM)
  - Require passenger lap/shoulder belts in new motorcoaches
- Could lap/shoulder belts mitigate injuries in a new motorcoach in a similar type of crash?

Simulation Study

- Two full rows
- Factors: Occupants, restraints, seat configuration

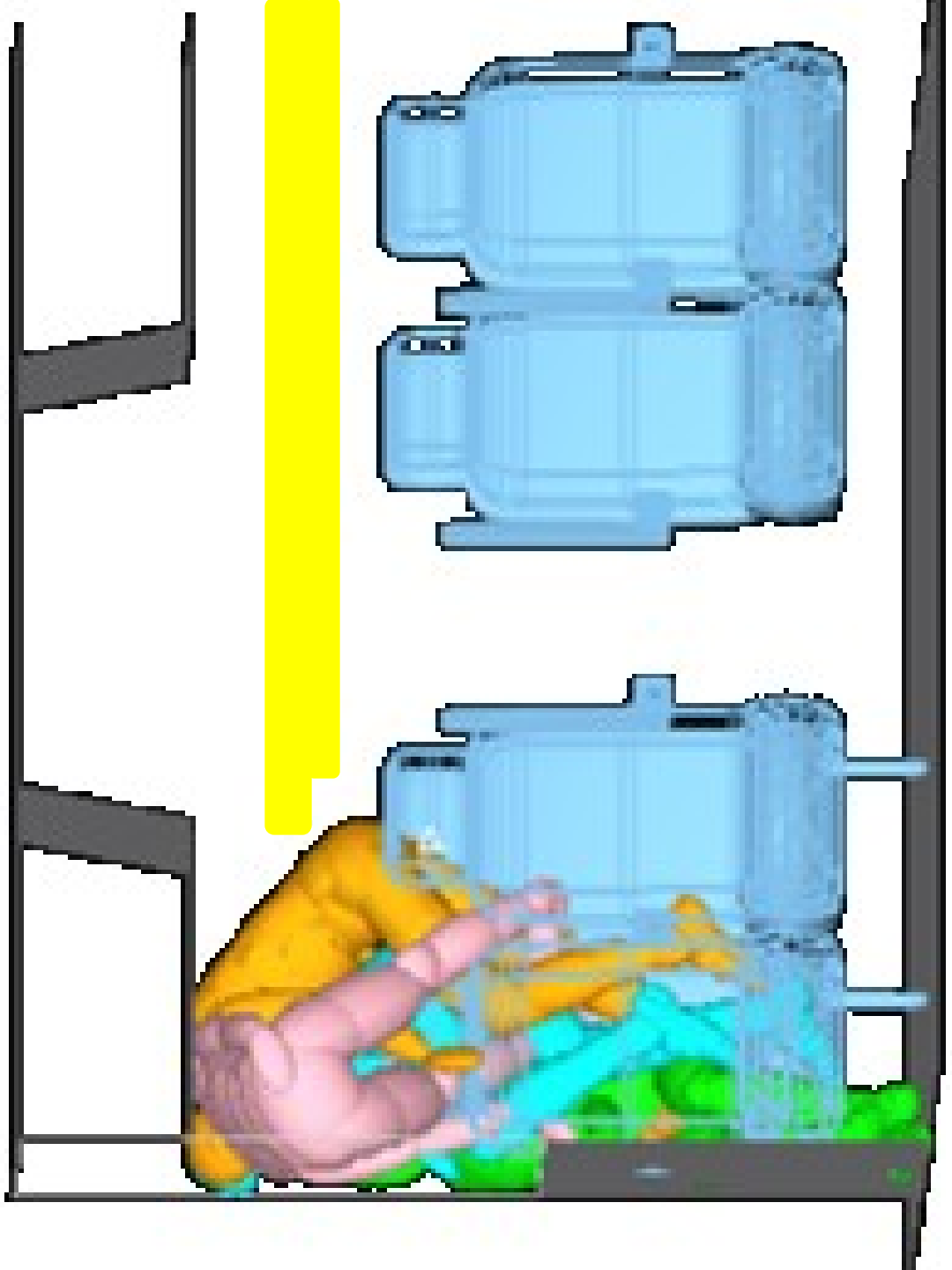


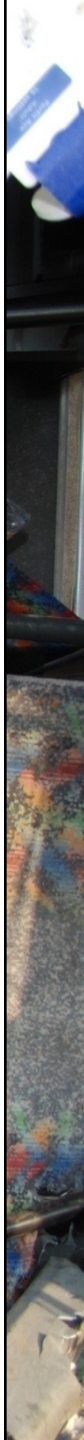
Occupant Simulation



Results - Unrestrained

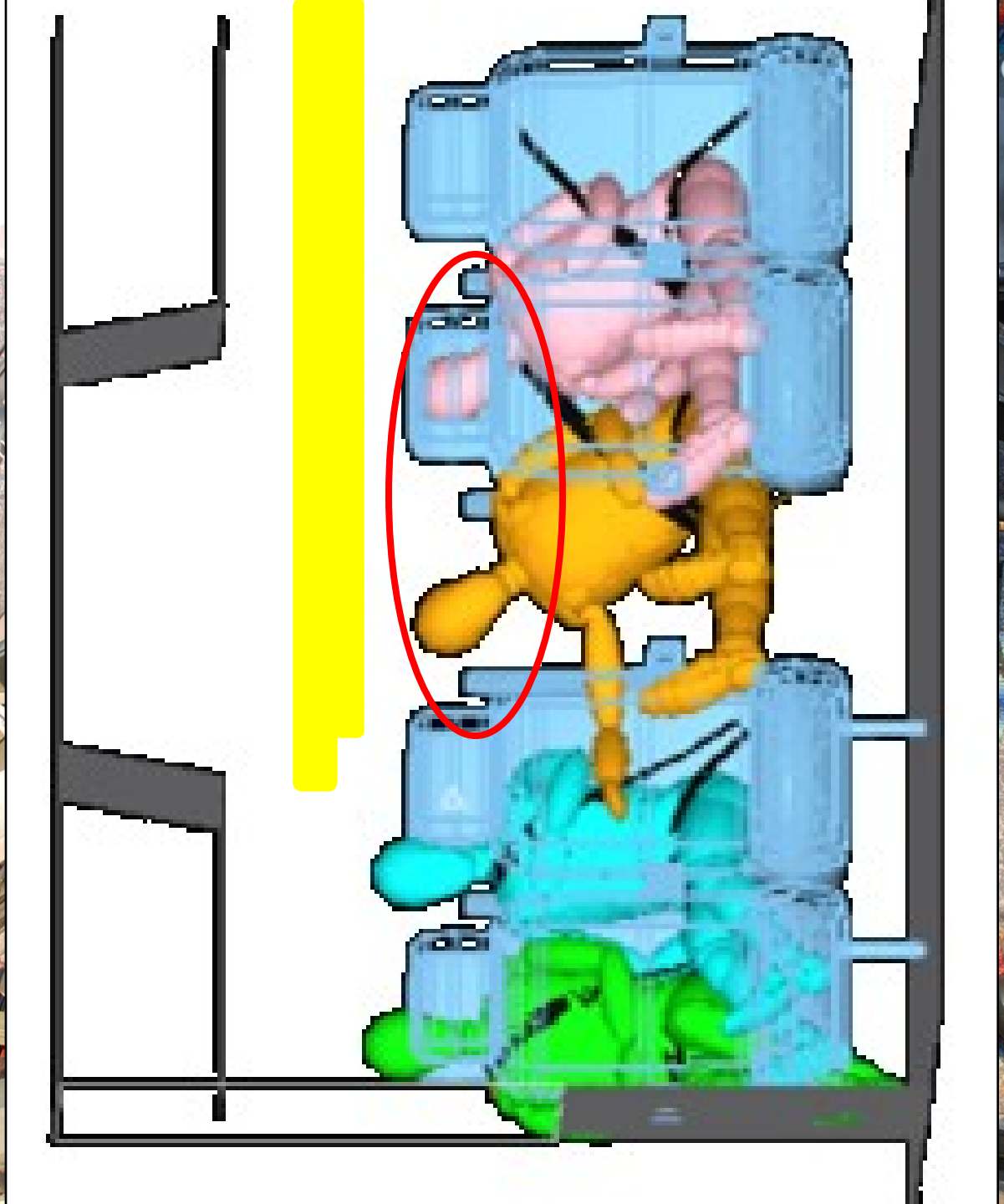
- Unrestrained passengers thrown from seats
- Vulnerable to
  - Injury during overturn
  - Intrusion from pole structure
  - Ejection

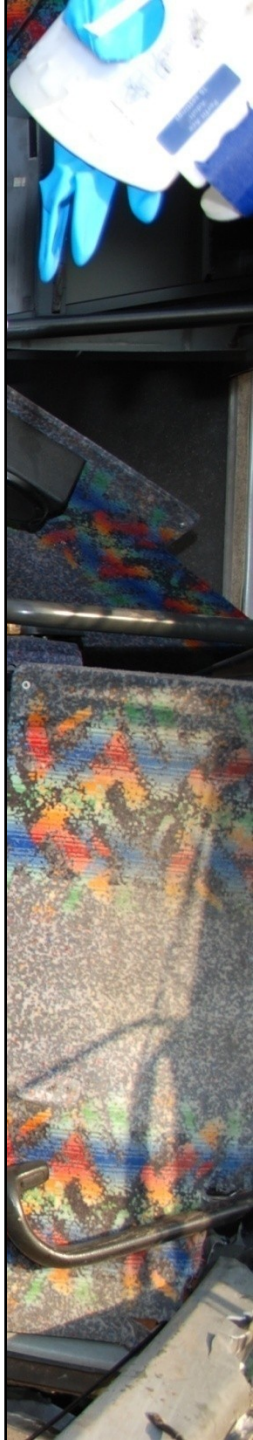


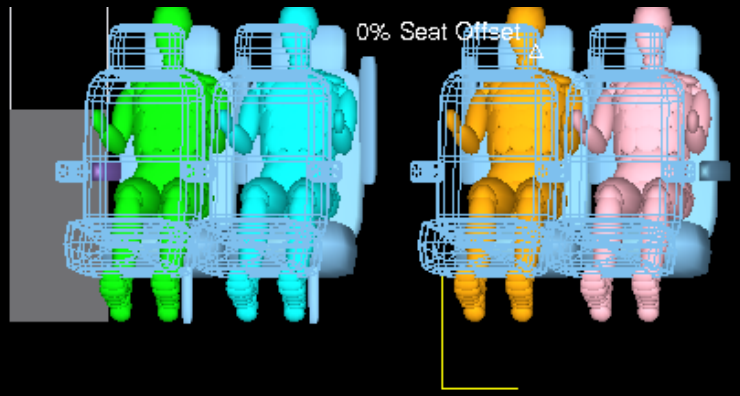


Results – Lap/Shoulder Belted

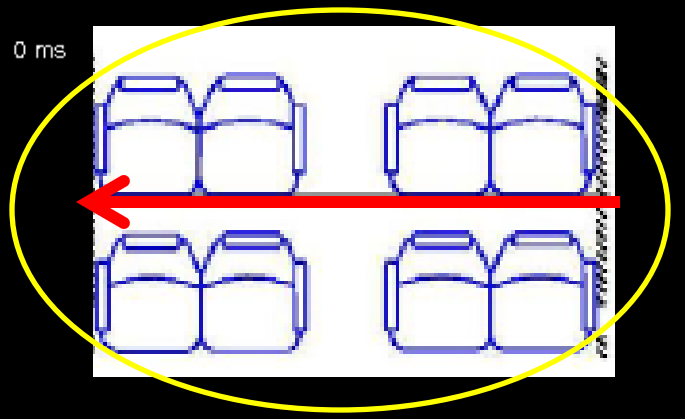
- Belted passengers contained within seats
  - Far-side occupants escaped shoulder harness
  - Low predicted injury levels

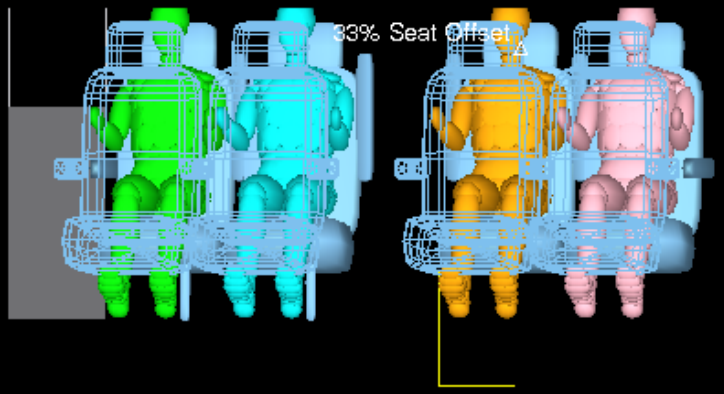




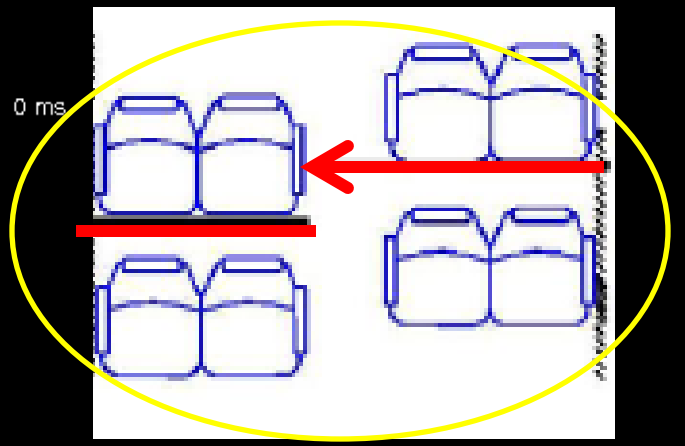


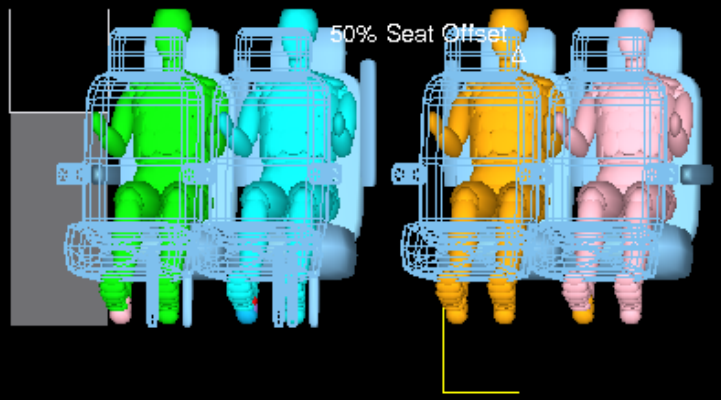
Aligned Seats



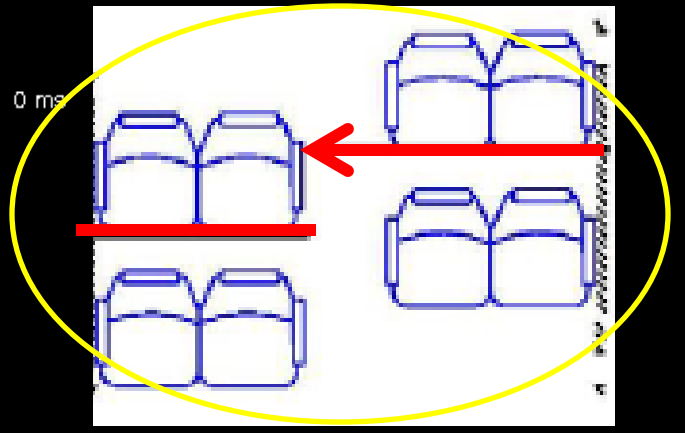


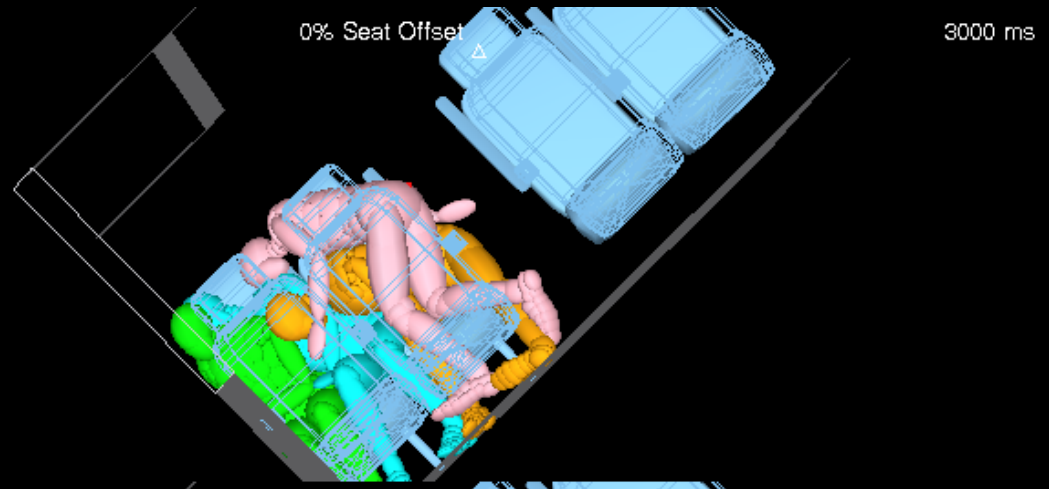
Partially Offset Seats





Fully Offset Seats





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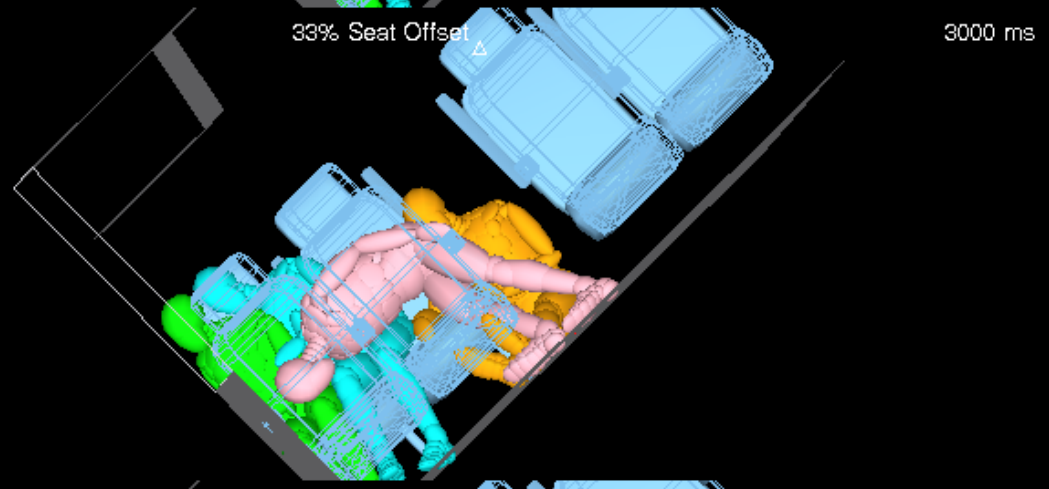

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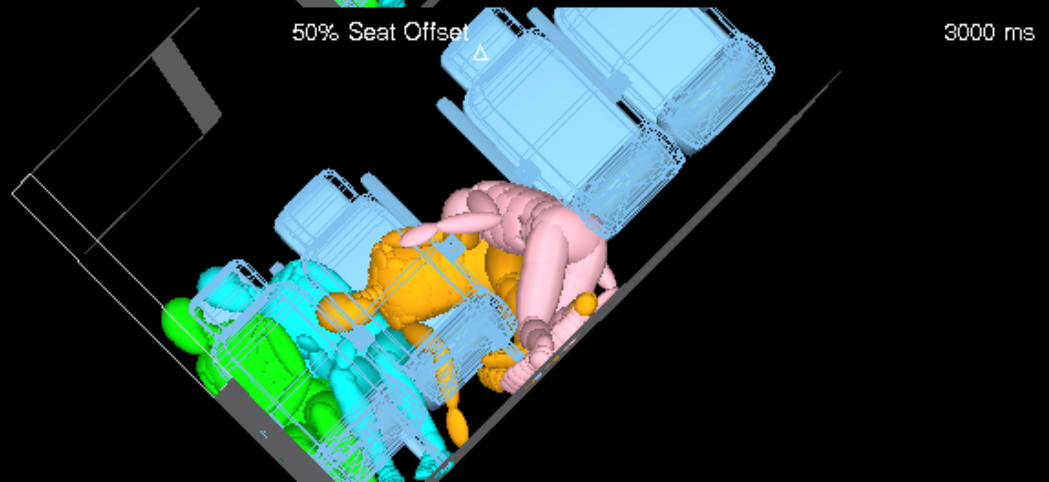

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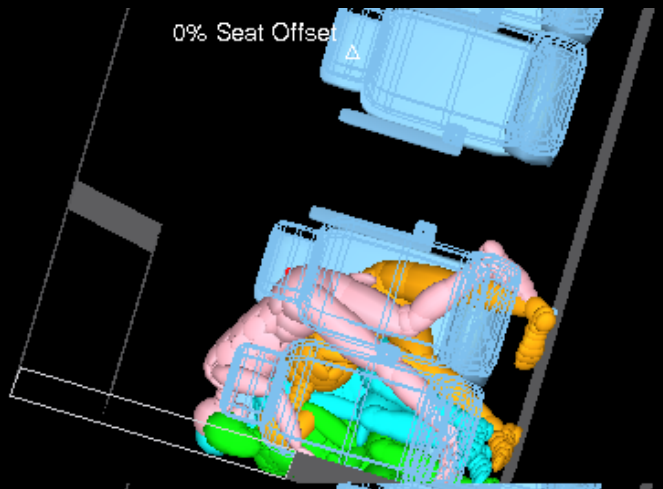

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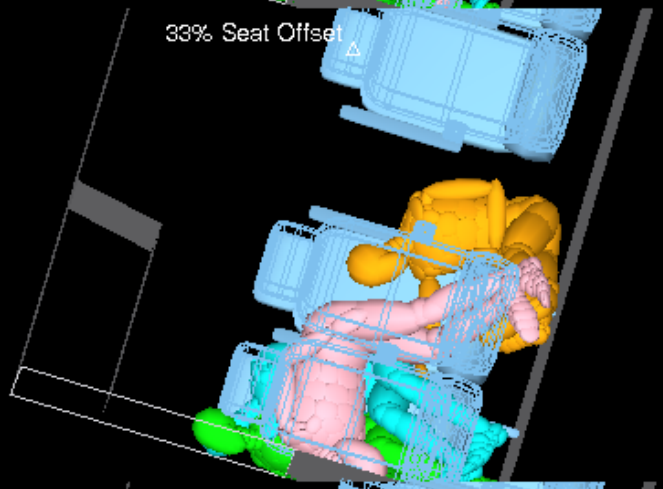

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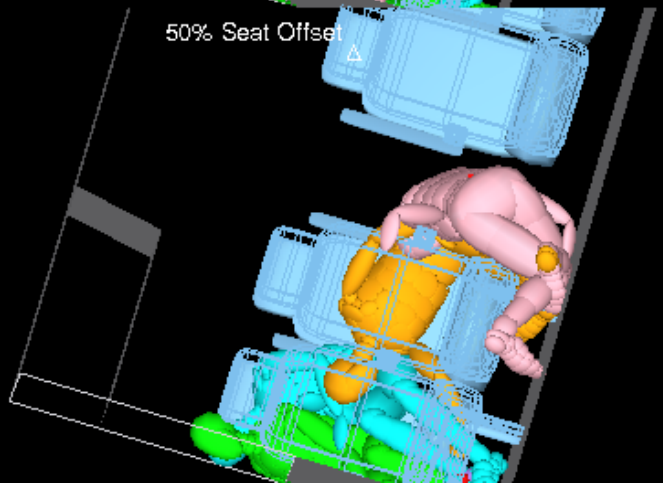

Fully Offset

Summary

- Overturn event created potential for injury
- Fatalities likely due to intrusion, not overturn event
- Lap/shoulder belts mitigate severity for some passengers (even for severe intrusion or roll event followed by impact)
- Seat spacing and armrest configuration should be considered as potentially affecting motorcoach interior safety

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